

The Northwest American Semelidae

BY

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(2 Plates; 7 Text figures)

INTRODUCTION

THIS IS THE SECOND ARTICLE based on research conducted while I was a graduate student at Stanford University, the Tellinidae having been discussed in an earlier paper (COAN, 1971). The main purpose of the present account is to put on record data on the systematics of the northwest American Semelidae, though not in as much detail as was possible in the case of the Tellinidae. The present survey also permitted the review of data on the geographic and geologic distribution and habitats of members of this family. These aspects are summarized at the end of the article.

The major previous accounts on this family in northwestern America were those of DALL (1915), GRANT & GALE (1931), and BURCH (1945a-1945c).

The detailed "Introduction," "Acknowledgments," and "Methods" sections of my earlier paper need not be repeated here, although special thanks are extended to Drs. Myra Keen, Warren Addicott, and Kenneth Boss who reviewed the present manuscript, and to Mr. Barry Roth who prepared the illustrations. The following abridged comments on format and abbreviations will permit the present paper to stand alone.

(1) The applicable synonymous species-level names are listed in chronological order, with the name to be used cited first and "first revisions," if any, indicated. Under each name are listed accounts published using those names and also accounts of type material pertinent to each. These works are listed in chronological order with major changes in generic allocation indicated in brackets above the account in which they were first employed. It is to be assumed that nearly all subsequent accounts used the same name combination. Other nomenclatural comments are

included in brackets after the account to which they refer.

The works listed do not represent a complete catalogue of literature but are the major accounts concerning living and fossil northwest American material, particularly those containing previously unpublished information or taxonomic innovations. Not included are books written largely for amateurs or general works on marine biology.

Numbers following dates (as 1851: 27) are page numbers.

(2) The type material pertinent to the valid name and its synonyms is discussed. Measurements given are of the greatest lengths of type specimens. When type material is no longer extant the dimensions from original accounts or of original illustrations are given. (In most early accounts the illustrations were usually printed at natural size, though this was rarely stated.) Photographs of type specimens or of original illustrations are included.

(3) Type localities of the various nominal species are given. The original collector is also cited, and sometimes major collections are mentioned when this clarifies the history or location of the specimens.

(4) A nomenclatural commentary may be given to explain nomenclatural complications not made clear in the synonymy or in the discussion of type material.

(5) Description. A short diagnosis of each species is given that emphasizes distinguishing characters. Most features of internal shell morphology are not discussed in detail but are illustrated with line drawings.

(6) Geographic Distribution and Ecology. The end-points of the distribution are given, together with reference to the source. The intermediate distributional data from between these end-points are summarized.

The sources of habitat information on each species other than from museum labels are indicated. I mention also the approximate number of lots examined.

(7) Geologic Distribution and Biogeography. The final section under each species is a summary of paleontologic records from published accounts. I have not listed all Pleistocene records, but generally have given only the end-points of their distributions and indicated the published accounts that form their bases. This is followed by notes on what seem to be related fossil species from earlier than the Pleistocene and related species in the Panamic province.

References are included under "Literature Cited" for all genera, species, and papers mentioned.

Conventions, symbols, and abbreviations used are as follows:

- ANSP – Academy of Natural Sciences, Philadelphia, Pennsylvania
 Berry collection – The private collection of Dr. S. Stillman Berry, Redlands, California
 BM(NH) – British Museum (Natural History), London, England
 CAS – California Academy of Sciences, San Francisco, California
ex (Conrad) MS – from the manuscript name of (Conrad)
 ICZN – International Commission on Zoological Nomenclature, or International Code of Zoological Nomenclature (Stoll *et al.*, 1964)
 LACM – Los Angeles County Museum of Natural History, Los Angeles, California
 m – meter(s)
 MCZ – Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts
 mm – millimeter(s)
 not, not of – as in the case of homonyms or misidentifications
 pair – the two valves of one specimen
 SBMNH – Santa Barbara Museum of Natural History, Santa Barbara, California
 SDNHM – San Diego Natural History Museum, San Diego, California
 SU – Stanford University, Stanford, California
 UCLA – University of California at Los Angeles, California
 USNM – United States National Museum, Smithsonian Institution, Washington, District of Columbia

SYSTEMATIC ACCOUNT

SEMELIDAE Stoliczka, 1870

KEEN (1969) recognized both the Semelidae and the family Scrobiculariidae H. & A. Adams, 1856, but a preliminary survey of pertinent literature suggests that such a division may be untenable. There are no clear-cut points of distinction between the two groups. If this proves to be true, a petition to the International Commission on Zoological Nomenclature to give precedence to the name "Semelidae" might be in order.

There are a number of accounts on the functional anatomy of European species of the genera *Abra* and *Scrobicularia*, and a review of many of these can be found in YONGE (1949). Our knowledge of the soft parts of the two genera known to be represented in northwest America, *Semele* and *Cumingia*, is limited to the following: a description of the anatomy of *Semele solida* (Gray, 1828) by SCHRÖDER (1916), discussions of the mantle currents in *Semele decisa* (Conrad, 1837) by KELLOGG (1915) and STASEK (1963), a discussion of the heart and pericardial gland of *Semele sinensis* (A. Adams, 1854) [now known as *S. cordiformis* (Holten, 1802)] by WHITE (1942) and a brief description of the anatomy of *Cumingia* by DESHAYES (1857).

The familial and generic classification of these genera is much in need of review, and this would be an excellent project for someone to undertake.

Semele Schumacher, 1817

[Type species: *Semele reticulata* Schumacher, 1817,
 = *Tellina proficua* Pulteney, 1799; by monotypy]

Into the genus *Semele* are placed species with medium-sized to large shells. They are equilateral or longer anteriorly and are variously sculptured. Most are brightly colored. The resilium is located in an elongate depression on the hinge plate. Lateral teeth are present, generally most prominent in the right valve. There are anterior to the resilium two weak cardinal teeth in each valve which are nearly equal in size. The pallial sinus is not confluent with the ventral pallial line and ascends obliquely.

An insufficient number of generic taxa are as yet proposed to divide west American species meaningfully into subgenera. It appears that *Semele incongrua* Carpenter, 1864, and allied Panamic species might be placed into the subgenus *Amphidesma* Lamarck, 1818 [type species: *A. variegata* Lamarck, 1818; by subsequent designation of CHILDREN, 1822]. *Semele rupicola* Dall, 1915, and its

Galápagos Island homologue might fit into *Elegantula* de Gregorio, 1884 [type species: *Semele fazisa* de Gregorio, 1884 = *Amphidesma striatus* Reeve, 1853; by monotypy].

Semele decisa (Conrad, 1837)

(Figures 1 to 3 and 14)

Amphidesma decusum Conrad

CONRAD, 1837: 239; plate 19, figure 2 [as *A. "decisa"*]
REEVE, 1853: plate 4, figure 24

[*Semele*]

CARPENTER, 1857a: 213
CARPENTER, 1857b: 195, 228, 231, 303, 351
CARPENTER, 1864b: 536, 540, 640 [1872: 22, 26, 126]
GABB, 1869: 94
ARNOLD, 1903: 165 - 166
DALL, 1915: 25
I. OLDROYD, 1925: 179
GRANT & GALE, 1931: 376, 908; plate 14, figures 13a, 13b
BURCH, 1945a: 17, 19 (text figure); 1945b: 17
HERTLEIN & STRONG, 1949: 242
KEEN, 1966: 171

Amphidesma rubrolineatum Conrad [first revision herein]

CONRAD, 1837: 239; plate 18, figure 11 [as *A. "rubro-lineata"*]

[*Semele*]

CARPENTER, 1857a: 212 [as a synonym of *S. simplex* (Adams & Reeve, 1850)]
CARPENTER, 1857b: 163, 195, 232, 303, 351
CARPENTER, 1864b: 536, 640 [1872: 22, 126]
DALL, 1915: 27 - 28
KEEN, 1966: 171

Semele rubrotincta Carpenter, "ex Conrad MS" [a misspelling for *Amphidesma rubrolineatum*]

CARPENTER, 1857b: 284, 352

Type Material:

Amphidesma decusum - BM(NH) Nuttall collection 1861.5.20.137, holotype, pair, 49 mm. Conrad's stated measurement of 127 mm is too large. Figure 1.

Amphidesma rubrolineatum - Lost (CARPENTER, 1857a; KEEN, 1966). The original figure measures 25 mm. Figure 2.

Type Localities:

Amphidesma decusum & *A. rubrolineatum* - "In the vicinity of" San Diego, California; T. Nuttall, in "deep water."

Nomenclatural Commentary:

CARPENTER (1857a, 1857b), following an opinion of Hugh Cuming, suggested that Conrad's *Semele rubrolineata* might be a synonym of *Amphidesma simplex* Adams & Reeve, 1850 and that the latter might be from California rather than the original "China Sea." Later, however, he speculated that *S. rubrolineata* might represent young *S. decisa* (Carpenter, 1864b). This last opinion seems correct. The original illustrations and photographs of the type specimens (BM(NH) 3 unnumbered syntypes) of *Semele simplex* show that the shell of this presumably Asian species is more elongate, and according to the original description is golden within and has an overall rosy color. Young *S. decisa* (Figure 3) have rosy rays, as mentioned in Conrad's description of *S. rubrolineata*. Conrad's illustration is poor, but I can see no reason to doubt his locality, nor is there reason to doubt the original locality of *S. simplex*. The action of a "first reviser" is needed (ICZN Article 24a).

CARPENTER (1857a) discussed Gould's suggestion that *S. decisa* might prove identical to *S. rosea* (Sowerby, 1833b). However, the latter is distinct in having regular concentric sculpture and a pink color within. It occurs from southern Mexico to Peru.

Description:

Large (to 94 mm); rounded; right valve more inflated; heavy; longer anteriorly in young to equilateral adult; rounded anteriorly; truncate postero-ventrally; antero-dorsal margin slightly concave near beaks, with a weakly developed lunule; postero-dorsal margin relatively straight, detectably beveled; sculpture of heavy, irregular concentric undulations and granular striae arranged in a somewhat radial pattern, most pronounced posteriorly; periostracum thin, generally worn off in adult and present only as dorsal and ventral fragments; externally with a light purplish tinge, darker between concentric undulations, and sometimes with reddish radial rays, particularly near beaks and in juvenile specimens; hinge area tinged purple both externally and internally; conspicuously punctate within, purple; pallial sinuses large, upturned. Other internal details as in Figure 14. Juvenile specimens smoother, with a more abrupt postero-dorsal slope than those of the next species.

Geographic Distribution and Ecology:

Coal Oil Point (SBMNH 23476) and Santa Rosa Island (Fitch, in correspondence), Santa Barbara County, California, to Cabo San Lucas, Baja California Sur (CAS 17663a), with many intermediate records. A specimen at

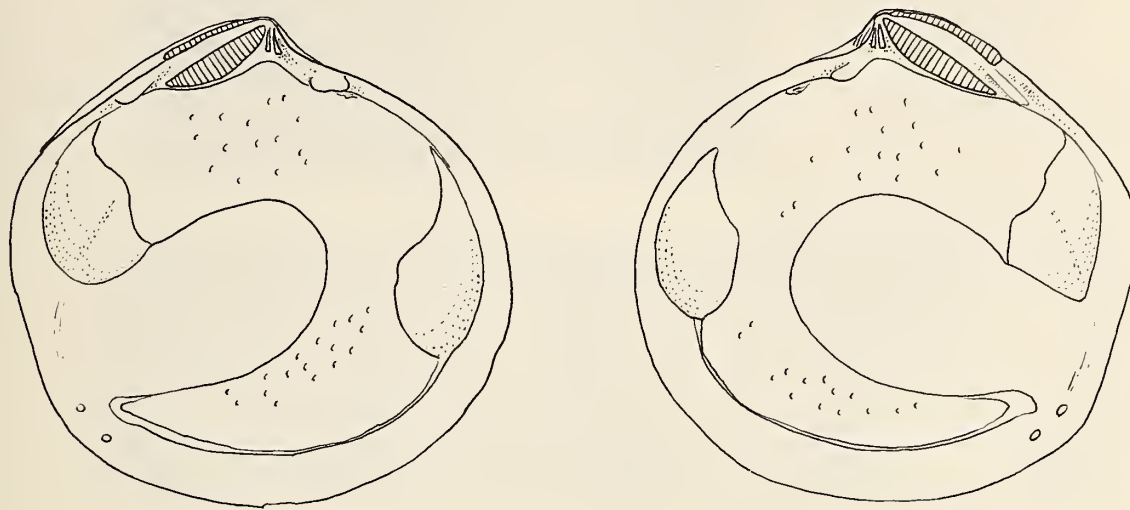


Figure 14

Semele decisa

internal view of valves, MCZ 86934, San Diego, California; 78.5 mm

Harvard University (MCZ 233099) labeled "Puerto Peñasco," Sonora, probably represents an error in labeling. This species is found in protected intertidal areas among rubble but sometimes in sand to 46 m (BURCH, 1945a).

Material seen:

109 lots.

Geologic Distribution and Biogeography:

This species is well represented in the late Pleistocene, with records from Tomales Bay, California (DICKERSON, 1922; WEAVER, 1949; ADDICOTT, 1966), to Bahía Magdalena, Baja California Sur (JORDAN, 1936), with many intermediate localities. It is known from the early Pleistocene of San Pedro, California (ARNOLD, 1903; CLARK, *in* NATLAND, 1957). There are records from southern Californian formations transitional between the Pliocene and the Pleistocene and from the Pliocene of the Los Angeles basin.

There are no described fossil species in northwest America that resemble *Semele decisa*. On the other hand, it is

one of a group of large species of *Semele*, the rest of which occur in the Panamic province. In fact, it is apparently homologous to *Semele punctata* (Sowerby, 1833b), known from the Recent (KEEN, 1971) and the Pleistocene (HERTLEIN & STRONG, 1939) of the Galápagos Islands. The latter differs in being smaller, more elongate, more rounded posteriorly, more flattened; the pallial sinus is more rounded and less dorsally directed; the sculpture is proportionately heavier, with more elongate radial pustules, essentially constituting radial sculpture. The beaks often have an orange flush, as opposed to the purple of the Californian species. I suggest that these two species represent isolated populations of what was once one species, perhaps in the Pliocene.

I know of no similar Asian or Caribbean species.

Its establishment in Tomales Bay in the Pleistocene, north of its present northern limit, may have been the result of larval settlement in one of the warm interglacial periods, although it may have remained for a time after its introduction. (It could also represent a relict population of a once wider distribution for which evidence is not yet known.)

Semele rubropicta Dall, 1871

(Figures 4 and 15)

Semele rubropicta Dall

DALL, 1871: 144 - 145, 160; plate 14, figure 10

DALL, 1915: 26

I. OLDROYD, 1924: 56, 212; plate 22, figure 10

I. OLDROYD, 1925: 180; plate 43, figure 10

DALL, 1925: 36, 37; plate 18, figures 1, 2

GRANT & GALE, 1931: 376

BURCH, 1945a: 17; 1945b: 17; 1945c: 30

Amphidesma rubrolineatum Conrad, of authors, not of Conrad

[not CONRAD, 1837: 239; plate 18, figure 11]

[*Semele*]

CARPENTER, 1864b: 627 [1872: 113]

Type Material:

USNM 101960, lectotype herein, left valve, 39.8 mm; USNM 678001, paralectotype, right valve, evidently not the same specimen as lectotype; ANS P 51749, probable paralectotype, right valve, 39.4 mm. The latter was probably that figured and measured (39.3 mm) by DALL (1871); however, its broken condition, its present lack of exact data, and the fact that DALL (1925) illustrated the here-chosen lectotype have decided the selection made. Figure 4.

Type Locality:

Soquel [Capitola], California; W. H. Dall, on "beach."

Nomenclatural Commentary:

None necessary.

Description:

Medium-sized (to 50 mm); ovate-elongate; equivalve; average in thickness for size; markedly longer, rounded anteriorly; only slightly truncate posteriorly; antero-dorsal margin slightly concave near beaks forming a weak lunule, convex distally; postero-dorsal margin weakly convex, slightly beveled; sculpture of concentric undulations, predominating in southern populations, and radial striae,

most prominent in northern populations; periostracum thin, more adherent than in other species, but sometimes present only as dorsal and ventral fragments; externally with a pinkish hue, red radial rays, and a purplish tinge on hinge; internally smooth, white; pallial sinus large. Other internal details as in Figure 15. Juveniles are more covered with periostracum (particularly northern specimens) and are more elongate than those of the preceding species.

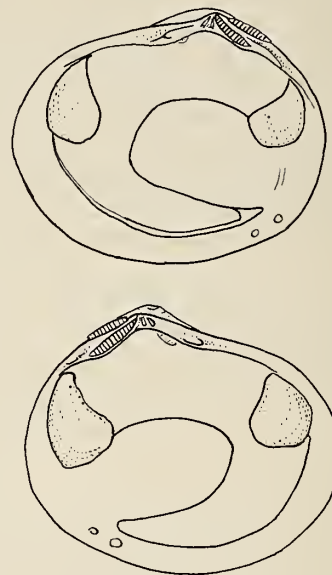


Figure 15

Semele rubropicta

internal view of valves, MCZ 60100, Eagle Island, Puget Sound, Washington; 52 mm

Geographic Distribution and Ecology:

Craig, Prince of Wales Island, Alaska (UCLA 20522), to the Strait of Juan de Fuca, Washington (MCZ 68842), with several intermediate localities, including throughout Puget Sound; Bodega Bay, California (Pacific Marine

Explanation of Figures 1 to 5

Figure 1: *Semele decisa*. Holotype of *Amphidesma decisa*, BM (NH) Nuttall collection 1861.5.20.137; 49 mm

Figure 2: *Semele decisa*. Original figure of *Amphidesma rubrolineatum*; 25 mm

Figure 3: *Semele decisa*, USNM 590481, Mission Bay, San Diego, California; 26 mm

Figure 4: *Semele rubropicta*, lectotype (herein), USNM 101960; 39.8 mm

Figure 5: *Semele rupicola*, lectotype (herein), USNM 272099; 19 mm

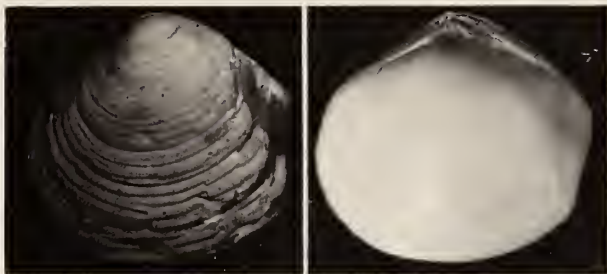


Figure 1



Figure 2



Figure 3



Figure 4

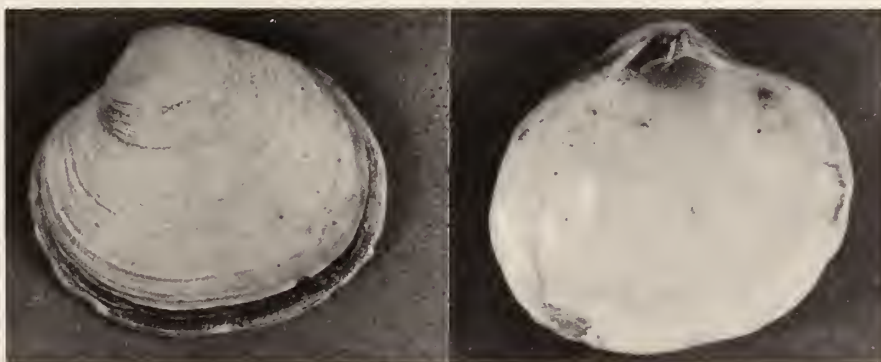


Figure 5

Station collection), to Isla Natividad, Baja California Sur (LACM 72-117), with several intermediate localities. This species is not yet known from between northern Washington and Bodega Bay. A specimen (SDNHM 15261) labeled "Guaymas" probably represents an error in labeling. Occurrence is from the intertidal area to 91 m, on a variety of bottom types, most often on coarse sediments (BURCH, 1945a; SMITH & GORDON, 1948; QUAYLE, 1960). KIRSOP (1922) found it to occur in numbers of 78 per m² in 21 to 25 m.

Material seen:

91 lots.

Geologic Distribution and Biogeography:

In the late Pleistocene, the species is known from Cayucos, California (VALENTINE, 1958), to Bahía Magdalena, Baja California Sur (JORDAN, 1924, 1936), with a number of intermediate records. There are records in the early Pleistocene of the San Pedro area, California (T. OLDROYD, 1925; CLARK, 1931; BURCH, 1947), as well as several in the Pliocene of California.

The lack of specimens from the late Pleistocene from north of Cayucos suggests that living northern populations may represent a settlement during an interglacial period. However, unlike the occurrence of *Semele decisa* in Tomales Bay in the late Pleistocene, the immigration of *S. rubropicta* into the Puget Sound area was apparently successful, the species perhaps having been protected by the warmer temperatures of that area. Gene flow between northern and southern populations is not yet proven, but the morphological differences are not yet sufficient to regard the two populations as subspecies. The problem invites further study.

Semele rubropicta seems more closely related to fossil species of the northwest American area than to any Recent Panamic species. It seems especially close to *S. fausta* Nomland, 1917, from the Pliocene of central California. Other related species may be *S. sylviaensis* Weaver, 1912, from the Miocene and Pliocene of Washington; *S. vancouverensis* Clark & Arnold, 1923, from the Oligocene of Vancouver Island; and *S. reaganii* Dickerson, 1917, from the Oligocene of Washington.

Semele rupicola Dall, 1915

(Figures 5 and 16)

Semele rupicola Dall

DALL, 1915: 26

I. OLDROYD, 1925: 180; plate 11, figures 9, 10

BURCH, 1945a: 17; 1945b: 17

KEEN, 1958: 200-201; text figure 495

Amphidesma rupium Sowerby, of authors, in part, not of Sowerby

[not SOWERBY, 1833b: plate 1, figure 12]

[*Semele*]

CARPENTER, 1864b: 611, 640, 684 [1872: 97, 126, 170]

Type Material:

USNM 272099, lectotype herein, left valve, 19 mm;

USNM 663892, paralectotype, smaller left valve.

The lot selected is the only one in the USNM with the name "*Semele rupicola*" written on it, and we can be reasonably certain that Dall examined this lot prior to naming the species. There is no material in the USNM from Santa Cruz, California, the only specific locality mentioned by DALL (1915). Figure 5.

Type Locality:

Santa Barbara, California; W. H. Dall.

Nomenclatural Commentary:

Early records of this species were of its Galápagos relative, *Semele rupium* (Sowerby). Misidentified, light-colored young specimens of this species account for Californian Recent (DALL, 1915, based on USNM 109039) and Pleistocene (KANAKOFF & EMERSON, 1959) records of *S. striosa* (C. B. Adams, 1852a). The latter, now relegated to the synonymy of *S. bicolor* (C. B. Adams, 1852a), occurs from the Gulf of California to Panama and is more regular in shape (KEEN, 1971).

Description:

Medium-sized (to 53 mm); ovate to rounded, but frequently deformed by its nestling habit; equivalve or nearly so; heavy for size; rounded, slightly produced anteriorly; longer, generally weakly truncate posteriorly; antero-dorsal margin somewhat concave near beaks forming a weak lunule; postero-dorsal margin rounded, somewhat beveled; sculpture of irregular concentric lamellar ridges and fine radial striae; periostracum dark, worn off in adult and present only as ventral fragments; exterior not conspicuously colored; punctate within, red around margins, occasionally with an orange hue; pallial sinuses relatively small. Other internal details as in Figure 16. Juveniles are more regular in outline, without conspicuous concentric sculpture.

Geographic Distribution and Ecology:

South Farallon Island, California (CAS 32813); Monterey, California (SU 4361, 21330), to Cabo San Lucas, Baja California Sur (USNM 663892), with numerous intermediate records. It occurs from the inter-

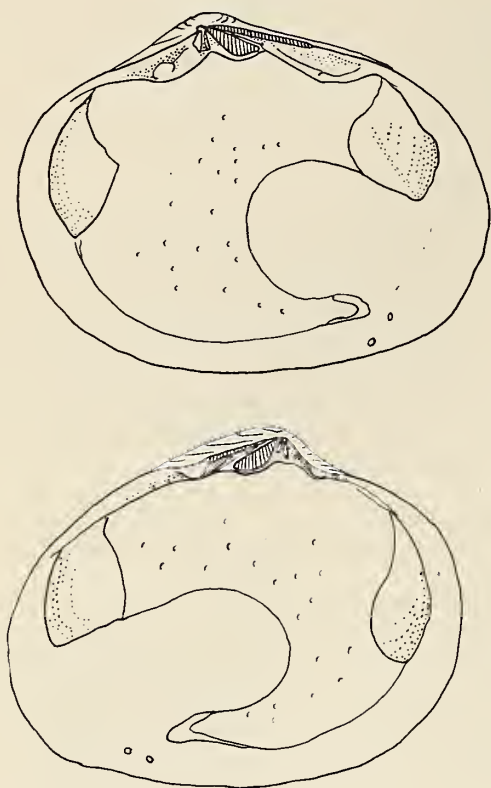


Figure 16

Semele rupicola

internal view of valves, MCZ 176237, San Diego, California; 32.6 mm

tidal area to 27 m, perhaps as deep as 46 m, nestling in rock crevices and among *Mytilus* (BURCH, 1945a; SMITH & GORDON, 1948).

Material seen:

87 lots.

Geologic Distribution and Biogeography:

In the late Pleistocene, this species has been recorded from Cayucos, California (VALENTINE, 1958), to Rosario, Baja California Norte (VALENTINE, 1957). It has also been recorded in the early Pleistocene of San Pedro, California (VALENTINE & MEADE, 1961).

The biogeographic relationships are similar to those of *Semele decisa*. Ancestral species are unknown on the West Coast, but a homologous form is present on the Galápagos Islands, *S. rupium* (Sowerby), known from both the

Pleistocene (HERTLEIN & STRONG, 1939) and the Recent (KEEN, 1971). *Semele rupium* seems to differ from *S. rupicola* in being more quadrate, having heavier radial sculpture and a more orange hue internally, but additional material should be studied to provide a more detailed comparison.

***Semele incongrua* Carpenter, 1864**

(Figures 6, 7 and 17)

***Semele incongrua* Carpenter**

CARPENTER, 1864b: 611, 640 [1872: 97, 126]

CARPENTER, 1865-1866: 208 - 209 [as *S. "incungrua"*]

DALL, 1915: 27

I. OLDROYD, 1925: 181; plate 11, figures 12, 13

GRANT & GALE, 1931: 377

BURCH, 1945a: 18; 1945b: 17

HERTLEIN & STRONG, 1949: 248 - 249

PALMER, 1958: 16, 27, 38, 48, 110 - 111, 338 - 339; plate 14, figures 7 - 10

***Semele pulchra montereyi* Arnold**

ARNOLD, 1903: 166 - 167, 392; plate 15, figures 3, 3a

GRANT & GALE, 1931: 377

BURCH, 1945a: 18

Type Material:

Semele incongrua - USNM 663888, lectotype herein, pair, 14.5 mm; Redpath Museum, paralectotypes. The USNM specimen also bears the California State Collection number 1061. Figure Figures 6 and 17.

Semele pulchra montereyi - USNM 162526, holotype, right valve, 18.7 mm. Figure 7.

Type Localities:

Semele incongrua - Catalina Island, California; J. G. Cooper, 73 to 110 m.

Semele pulchra montereyi - "Deadman Island," San Pedro, California; Lower San Pedro formation, early Pleistocene; R. Arnold.

Nomenclatural Commentary:

Arnold's subspecies, proposed as a "variety" of *Semele pulchra* (Sowerby, in Broderip & Sowerby, 1832), presumably by mistake, was described as being more oval, thicker, with less angular and more anteriorly placed beaks. It was synonymized with *S. incongrua* by DALL (1915). GRANT & GALE (1931) listed it as a distinct Pleistocene subspecies, but they did not give any reasons for so regarding it. BURCH (1945a) suggested that the name could also be applied to a northern Recent subspe-

cies. HERTLEIN & STRONG (1949) indicated that the fossil subspecies might be separable in being more rounded and in having more pronounced sculpture.

Each of the points of distinction advanced by ARNOLD (1903) and by HERTLEIN & STRONG (1949) are within the range of variation of mature specimens.

Description:

Small (to 25 mm); ovate-elongate; left valve somewhat more inflated; thin; longer, rounded anteriorly; rounded posteriorly; antero-dorsal margin beveled to form a lunule; postero-dorsal margin rounded; sculpture of concentric lamellar ridges, more conspicuous in right valve, and fine radial striae in the interstices; periostracum not evident; purplish tinge near beaks, sometimes with purplish radial rays; smooth internally, with purplish rays; pallial sinus large. Other internal details as in Figure 17.

Geographic Distribution and Ecology:

Monterey, California (USNM 204038 and many other lots) to Isla San Benito, Baja California Norte (SDNHM 28842), with many intermediate records. It has been taken from 9 to 192 m, in fine to coarse sand and nestling in borer holes in shale (BURCH, 1945a; SMITH & GORDON, 1948).

Material seen:

66 lots.

Geologic Distribution and Biogeography:

In the late Pleistocene, this species has been reported only from Newport Bay, California (BRUFF, 1946). In the early Pleistocene it is known from Santa Barbara,

California (ARNOLD, 1907a, 1907b) and from the San Pedro area, California (ARNOLD, 1903; T. OLDROYD, 1925; CLARK, 1931; BURCH, 1947; VALENTINE & MEADE, 1961). The relative scarcity of late Pleistocene records may be due to the fact that offshore deposits are better represented in the early Pleistocene of southern California; this is an offshore species.

It is similar to the Panamic *Semele venusta* (Reeve, 1853, ex A. Adams MS), which occurs from Acapulco, Guerrero, Mexico, to Colombia (KEEN, 1971). The shell of this Panamic species is larger, heavier, with more prominent beaks, and is more smoothly sculptured, with more rounded concentric lamellae. The pallial sinus in *S. venusta* is more pointed, and the shell is more conspicuously colored, with a dark purple hue and even darker Λ -shaped lines.

Semele incongrua has not been reported from the Pliocene. It may be related to *S. morani* Anderson & Martin, 1914, from the Miocene of central California and perhaps to *S. gayi* Arnold, 1908, from the Oligocene or Miocene of central California.

Semele pulchra (Sowerby, in Broderip & Sowerby, 1832)

(Figures 8 to 11 and 18)

Amphidesma pulchrum Sowerby, in Broderip & Sowerby
SOWERBY, in BRODERIP & SOWERBY, 1832: 57

SOWERBY, 1833b: plate 17, page 1, figure 2 [1841: page 7]

REEVE, 1853: plate 1, figure 2

[*Semele*]

CARPENTER, 1857b: 188, 280, 303

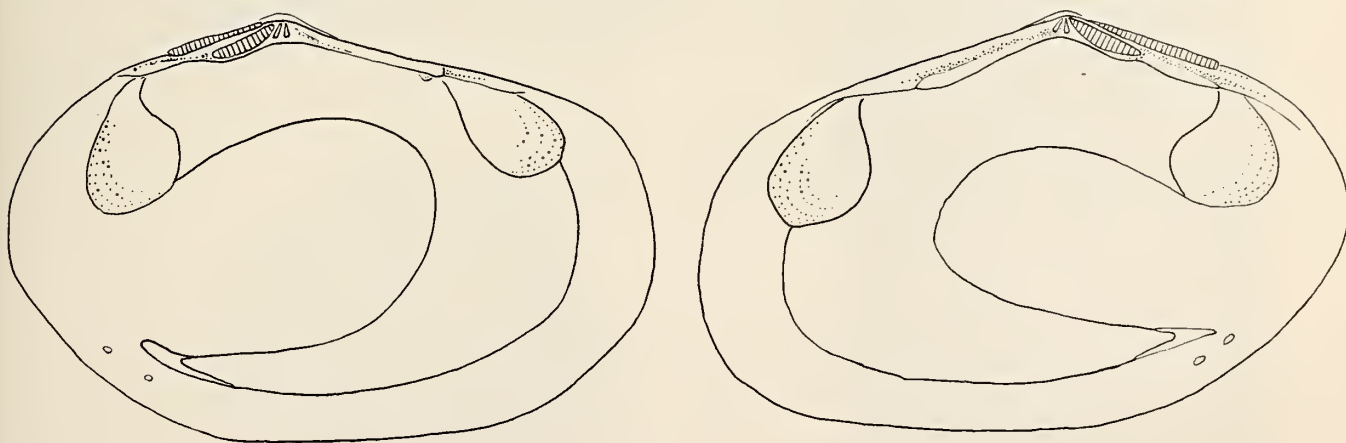


Figure 17

Semele incongrua

internal view of valves, USNM 663888, lectotype (herein); 14.5 mm

- CARPENTER, 1864a: 367 [1872: 203]
 CARPENTER, 1864b: 537, 553, 592, 611, 640, 668 [1872: 23, 39, 78, 97, 126, 154]
 ARNOLD, 1903: 166, 392; plate 15, figures 1, 1a
 DALL, 1915: 27
 I. OLDROYD, 1925: 181
 GRANT & GALE, 1931: 377
 BURCH, 1945a: 18; 1945b: 17
 HERTLEIN & STRONG, 1949: 246, 258; plate 1, figure 15
 KEEN, 1958: 198 - 199, text figure 492
 OLSSON, 1961: 368 - 369, 538; plate 65, figure 5
 KEEN, 1971: 253 - 254; text figure 641

Semele quentinensis Dall

- DALL, 1921: 22
 DALL, 1925: 26, 36; plate 8, figure 4
 GRANT & GALE, 1931: 377
 HERTLEIN & STRONG, 1949: 246 - 247, 258; plate 1, figure 10
 KEEN, 1958: 198 - 199; text figure 494
 KEEN, 1971: 253 - 254; text figure 643

Type Material:

Amphidesma pulchrum - BM(NH) without registry number, lectotype herein, pair, about 31 mm; paralectotypes, two smaller pairs. Figure 8.

Semele quentinensis - USNM 333114, lectotype herein, right valve, 13.8 mm; USNM 64516, paralectotypes, 4 valves. The lectotype selected is that figured by DALL (1925). Figure 9.

Type Localities:

Amphidesma pulchrum - Bahía de Caráquez, Ecuador; H. Cuming.

Semele quentinensis - Bahía San Quintín [as "San Quintín"], Baja California Norte; late Pleistocene [as "late Pliocene or early Pleistocene"]; C. R. Orcutt.

Nomenclatural Commentary:

HERTLEIN & STRONG (1949) considered *Semele pulchra* and *S. quentinensis* to be two separable species, with overlapping distributions from Nicaragua to Costa Rica. *Semele quentinensis* was said to be more elongate, more evenly rounded dorsally, thinner and more lightly colored.

I have illustrated two lots in addition to the type material demonstrating that some of these points of distinction do not hold. A specimen from San Diego, California (USNM 601034) (Figure 10) is markedly rounded, more so than the type of *Semele pulchra*, while a specimen from Panama (USNM 73494) (Figure 11) is almost as elongate as the type specimen of *S. quentinensis*.

A review of material in several collections suggests that there is one continuously occurring species, the differences seemingly being clinal.

Description:

Small (to 31 mm); ovate to ovate-elongate; equivalve; average in thickness; longer anteriorly to equilateral in some specimens; rounded anteriorly; weakly truncate posteriorly; antero-dorsal margin relatively straight, with a beveled lunule; postero-dorsal margin straight to slightly convex, with a beveled escutcheon; sculpture of fine, rounded concentric ribs and radial striae on the anterior end (occasionally with a few radial ribs on posterior end); periostracum not evident; externally with a purplish flush on beaks in Californian specimens, but with more color evident in Panamic material; smooth within, with a purplish or yellowish hue; pallial sinus relatively large. Other details as in Figure 18.

Geographic Distribution and Ecology:

Point Mugu, California (BURCH, 1945a); Redondo Beach, California (SU 53220), to Zorritos, Peru (OLSSON, 1961), with fairly numerous intermediate records. A lot at the Academy of Natural Sciences of Philadelphia (AN SP 51756) from Monterey, California, may either represent an error in labeling or the result of larval settlement in an especially warm year. It is found intertidally to 46 m. BURCH (1945a) records it from 15 cm in sand in bays and also from among rubble along the outer coast.

Material seen:

62 northwest American lots.

Explanation of Figures 6 to 13

Figure 6: *Semele incongrua*, lectotype (herein), USNM 663888; 14.5 mm

Figure 7: *Semele incongrua*. Holotype of *Semele pulchra montereyi*, USNM 162526; 18.7 mm

Figure 8: *Semele pulchra*. Lectotype (herein) of *Amphidesma pulchrum*, BM(NH) without registry number; about 31 mm

Figure 9: *Semele pulchra*. Lectotype (herein) of *Semele quentinensis*, USNM 333114; 13.8 mm

Figure 10: *Semele pulchra*, USNM 601034, Mission Bay, San Diego, California; 24.3 mm

Figure 11: *Semele pulchra*, USNM 73494, Panama; 26 mm

Figure 12: *Cumingia californica*, original figure; 31.8 mm

Figure 13: *Cumingia californica*. Lectotype (herein) of *Cumingia densilineata*, USNM 333115; 30.7 mm

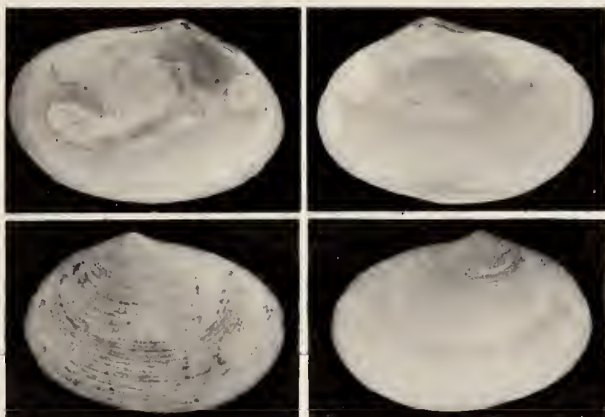


Figure 6

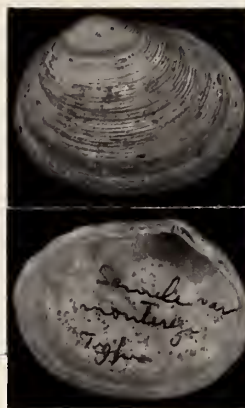


Figure 7



Figure 8

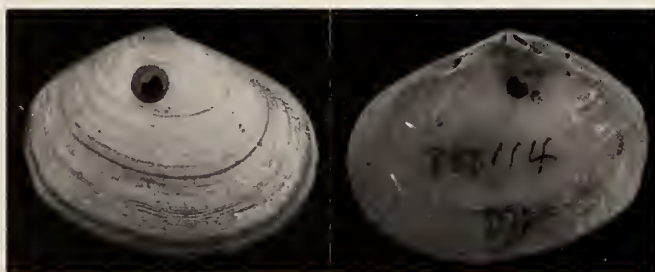


Figure 9



Figure 10

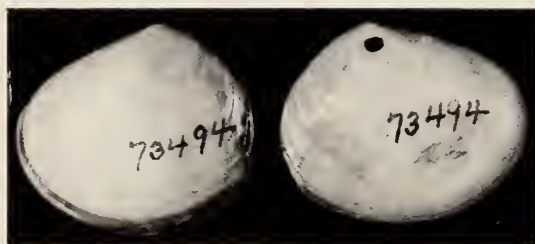


Figure 11



Figure 12



Figure 13

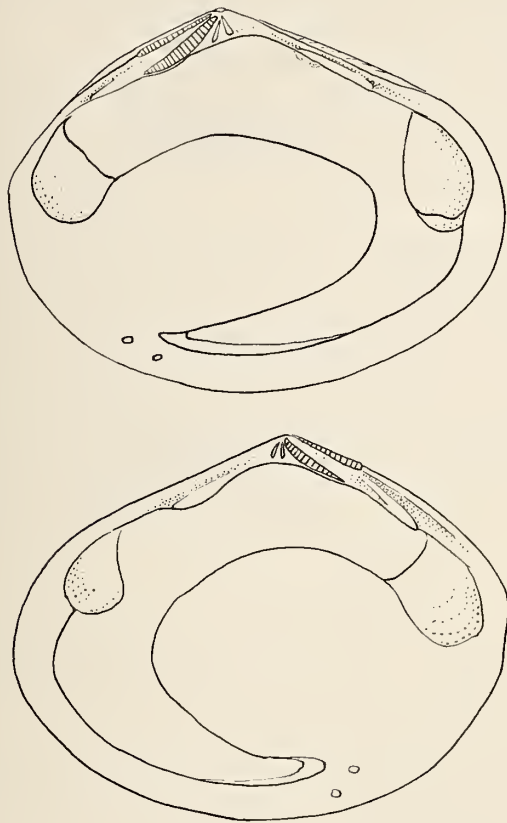


Figure 18

Semele pulchra

internal view of valves, MCZ 210445, San Diego, California; 20 mm

Geologic Distribution and Biogeography:

This species has been reported in the late Pleistocene from Anacapa Island, California (VALENTINE & LIPPS, 1963), to Bahía Magdalena, Baja California Sur (JORDAN, 1936), with many intermediate records. It has been recorded in the early Pleistocene only from the San Pedro, California, area (SCHENCK, 1945; BURCH, 1947).

Semele pulchra is closest to other living Panamic species, such as *S. guaymasensis* Pilsbry & Lowe, 1932; *S. pacifica* Dall, 1915; and *S. verrucosa* Mörch, 1860. The differences among them are discussed by KEEN (1971).

Cumingia Sowerby, 1833a

[Type species: *Cumingia lamellosa* Sowerby, 1833a; by subsequent designation of GRAY, 1847]

Into the genus *Cumingia* are placed species with small to medium-sized shells. They are equilateral to longer anteriorly and are rounded anteriorly and angular posteriorly. Their outline is often irregular due to a nestling habit, and they are smooth or sculptured with concentric lamellae. The shells are white, and the resilium is large and projecting. Two small cardinal teeth and two large lateral teeth occur in each valve; the latter are particularly prominent in the right. The pallial sinus is partly confluent with the pallial line.

Cumingia californica Conrad, 1837

(Figures 12, 13 and 19)

Cumingia californica Conrad

- CONRAD, 1837: 234; plate 17, figure 12
 CARPENTER, 1857a: 213
 CARPENTER, 1857b: 195, 231, 234, 245, 304, 351, 353
 CARPENTER, 1857c: 30
 CARPENTER, 1864b: 540, 640 [1872: 26, 126]
 GABB, 1869: 94
 DALL, 1900: 1001
 ARNOLD, 1903: 167
 BURCH, 1945a: 19; 1945b: 17
 HERTLEIN & STRONG, 1949: 251
 KEEN, 1966: 171

Cumingia lamellosa Sowerby, of authors, in part, not of Sowerby

- [not of SOWERBY, 1833a: 34]
 DALL, 1916: 28
 I. OLDROYD, 1925: 182
 GRANT & GALE, 1931: 378, 911, 920; plate 14, figure 23; plate 19, figure 1

Cumingia densilineata Dall

- DALL, 1921: 22
 DALL, 1925: 15, 36; plate 8, figure 5; plate 11, figure 2
 JORDAN, 1926: 244, 248 - 249; plate 25, figures 1, 3, 5

Type Material:

Cumingia californica - Lost (KEEN, 1966), but Conrad's figure is sufficient to identify the species; 31.8 mm (CONRAD, 1837). Figure 12.

Cumingia densilineata - USNM 333115, lectotype herein, pair, figured by DALL (1925: plate 11, figure 2), 30.7 mm; USNM 348044, paralectotypes,

3 valves. The location of the specimen figured by Dall on his plate 8, figure 5, is a mystery. Figure 13.

Type Localities:

Cumingia californica – near Santa Barbara, California; T. Nuttall, in "salt marshes" (probably in error, as the species occurs among rocks on the outer coast).

Cumingia densilineata – Bahía San Quintín, Baja California Norte; late Pleistocene [as "late Pliocene or early Pleistocene"]; C. R. Orcutt.

Nomenclatural Commentary:

For several years workers incorrectly synonymized the Californian species with the Panamic *Cumingia lamellosa*. The differences between these species are discussed below. DALL (1900) synonymized *C. similis* Adams, 1850, with *C. californica*. An examination of the type specimens of the former (BM(NH), without registry number) indicates that it is a synonym of the Panamic *C. lamellosa*; this view was followed by KEEN (1971).

Dall described *Cumingia densilineata* as differing from *C. californica* in having more closely-set, regular sculpture and a posterior end with straighter dorsal and ventral margins. JORDAN (1926) found his specimens to differ in being thinner and more delicate and illustrated an unusually thin valve (CAS Geology Type collection 1845).

Some live-collected specimens of *Cumingia californica* closely resemble the type material of *C. densilineata*. Indeed, the type lot of the latter contains both thick and thin specimens. I can see no justification at the present time to regard this material as representing a distinct species or subspecies.

A juvenile specimen of *Cumingia californica* (USNM 15579) is responsible for the Californian record of "*Tellina lamellata* Carpenter, 1857c." The type specimen of the latter, described from Mazatlán, Mexico, proved to be a juvenile *Semele* (KEEN, 1968, 1971).

Description:

Medium-sized (to 36 mm); ovate-trigonal, but generally conforming to nestling site; equivalve; heavy; approximately equilateral to somewhat longer anteriorly; rounded anteriorly; pointed, narrowly truncate posteriorly; antero-dorsal margin convex with a small concavity forming a weak lunule; postero-dorsal margin straight to slightly convex, conspicuously beveled to form an escutcheon; sculpture of heavy, concentric lamellae, more or less evenly distributed over surface; white outside, with remnants of dark periostracum ventrally; white within with

light radial striae within. Other internal details as in Figure 19.

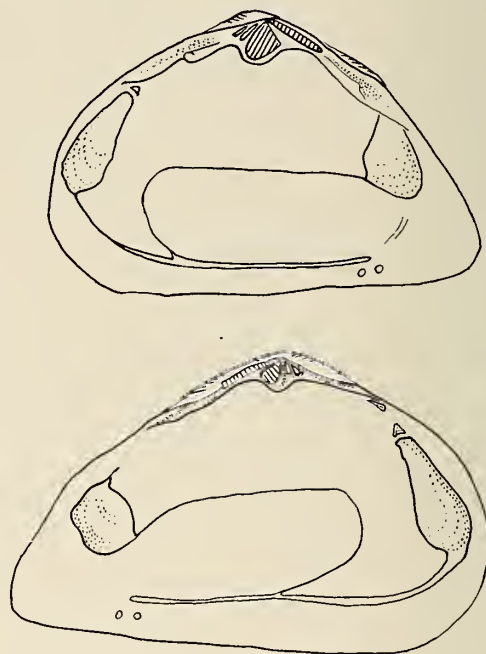


Figure 19

Cumingia californica

internal view of valves, MCZ 176003, Cayucos, California; 31.5 mm

Geographic Distribution and Ecology:

Crescent City, California (USNM 74188); Monterey, California (USNM 74218 and many other lots) to Bahía San Juanico, Baja California Sur (Berry collection 31639). NEWCOMBE's (1893) record from British Columbia is certainly in error, and the one lot from Crescent City is doubtful and needs confirmation. There are many lots and localities between Monterey and Bahía San Juanico. It occurs from the intertidal area to 64 m, nestling among rocks, in crevices, in holes of dead boring clams, and among attached animals on piers. It is also found on gravel bottoms in deeper water (BURCH, 1945a; SMITH & GORDON, 1948).

Material seen:

118 lots.

Geologic Distribution and Biogeography:

There are several records in the late Pleistocene from Cayucos, California (VALENTINE, 1958), to Bahía Magdalena, Baja California Sur (JORDAN, 1936). It is also known from the early Pleistocene of Santa Barbara (DIBBLEE, 1966) and the San Pedro area (ARNOLD, 1903; T. OLDROYD, 1925; BURCH, 1947; VALENTINE & MEADE, 1961), California. There are no related West American fossil species.

This species is closest to the common Panamic *Cumingia lamellosa* Sowerby, 1883a, which differs in being smaller, thinner, more irregular in shape, and in having proportionately fewer, more lamellar concentric ribs. It also has a more projecting chondrophore which is conspicuous even in young specimens. Juvenile specimens of *C. californica* are smoother, heavier, more regular in shape, and the chondrophore is hardly projecting at all. The ranges of the two species are not yet known to overlap on the outer coast of Baja California Sur.

OTHER SPECIES

A few other specific names were encountered during this study which have not yet been discussed.

(1) *Semele flavescens* (Gould, 1851) [described in *Amphidesma*] was based on a specimen supposedly from "San Diego, California." This is evidently in error, probably the result of the mixing of Lieutenant T. P. Green's specimens. Green also brought specimens to Gould from several localities on the west coast of Mexico (JOHNSON, 1964). This species is characteristic of the Panamic province and has not been recorded from north of Bahía Magdalena, Baja California Sur (BURCH, 1945a; HERTLEIN & STRONG, 1949; KEEN, 1971). Californian specimens at Stanford University (SU 188/2) cited by GRANT & GALE (1931) prove to be young *S. decisa*. HERTLEIN & STRONG (1949) mention a Dall record from "Catalina Island, California." I cannot find Dall's published account or USNM specimens that might have formed its basis, although there are USNM specimens of *S. decisa* from Catalina Island,

California, as well as an Isla Santa Catalina in the Gulf of California.

(2) *Semele californica* (Reeve, 1853, ex A. Adams MS) [described in *Amphidesma*] was reported from San Pedro, California, by WILLIAMSON (1892). This species is also Panamic and does not occur north of Bahía Magdalena, Baja California (KEEN, 1971).

(3) *Semele pacifica* Dall, 1915, was recorded at the time of its description from "Catalina Island, California." This record was based on a specimen (USNM 73921), which is clearly labeled as having come from Isla Santa Catalina, Gulf of California.

(4) There is a specimen of *Semele guaymasensis* Pilsbry & Lowe, 1932, at Harvard University (MCZ 105544) labeled as having been collected in 46 m off Redondo Beach, California, by Dr. Thomas Burch. This species is not reported by BURCH (1945a - 1945c) nor is it present in other collections from the same source. There are no records of it from outside the Gulf of California (KEEN, 1971). The label with the specimen, listing it as "*Semele incongrua*," is therefore probably in error, perhaps the result of mixing in shipment.

(5) *Theora (Endopleura) lubrica* Gould, 1861, described from Japan, has been collected in Anaheim Bay, southern California, by personnel of the California Department of Fish and Game. Insufficient data are available to ascertain whether this species has become firmly established.

(6) It is only a matter of time before deepwater members of the genus *Abra* are found off the northwest American coast (F. Bernard, personal communication). *Abra californica* Knudsen, 1970, was described from off Baja California Sur in about 3500 m, and other species have been recorded in the northern Atlantic (KNUDSEN, 1970).

ECOLOGY

The ecological information about the species is summarized in the following Table:

Table 1

Species	Depth range meters	Bottom type	Coastal exposure
<i>Semele decisa</i>	0 - 46	sand to rubble	semi-protected
<i>Semele rubropicta</i>	0 - 91	various, mostly coarse	semi-protected
<i>Semele rupicola</i>	0 - 27 (?64)	rock	exposed
<i>Semele incongrua</i>	9 - 192	fine to coarse sand	protected, offshore
<i>Semele pulchra</i>	0 - 46	sand to rubble	generally protected
<i>Cumingia californica</i>	0 - 64	rock and rubble	exposed